

OPERATION AND SERVICE MANUAL



MODELS

4040AT 4050AT 5060AT
4040AX 4050AX 5060AX

HYPOT® AND GROUND CONTINUITY TEST SET

905 Carriage Park Avenue
Lake Bluff, IL 60044-2248 U.S.A.
Ph. (847) 295-3312 • Fax (847) 295-9165
E-mail: info@asresearch.com
<http://www.asresearch.com>

FOR TECHNICAL ASSISTANCE
PHONE: 1 (800) 858-8378 (TEST)

PART NUMBER 36604

REVISION C

SECTION I

OPERATORS MANUAL

INTRODUCTION

This manual discusses the reasons dielectric withstand tests are required, the precautions necessary to ensure that the tests are done safely, and how such tests are accomplished on various classes of materials, components and products.

In later chapters, the features of Associated Research 4000 and 5000 Series Hypots® are explained, along with a step by step guide to their proper use. Finally, technical data is presented for all models.

Associated Research, Inc., has been manufacturing High Voltage Testing Instruments since 1936. Our line of Dielectric Withstand Testers (Hypots®) is the broadest line available today. These products are based upon designs from the early 1940's when AR manufactured the first commercial Hypot tester for Electric Motor Division of General Motors.

These instruments have gone through several generations of design improvements, building on reliable, field proven technology and contain the features and benefits our customers have requested.

Hypot® is a Registered Trademark of Associated Research, Inc.

SAFETY PRECAUTIONS REQUIRED FOR HIGH VOLTAGE TESTING

WARNING: A Hipot produces voltages and currents which can cause harmful or fatal electric shock. Respect for this is essential when handling and using the test instrument.

SERVICE AND MAINTENANCE

User Service

To prevent electric shock do not remove the instrument cover. There are no user serviceable parts inside. Refer servicing to an Associated Research, Inc. authorized service center. Schematics, when provided, are for reference only.

Service Interval

The instrument and its power cord, test leads, and accessories must be returned at least once a year to an Associated Research authorized service center for calibration and inspection of safety related components. Associated Research will not be held liable for injuries suffered if the instrument is not returned for its annual safety check and maintained properly.

User Modifications

Unauthorized user modifications will void your warranty. Associated Research will not be responsible for any injuries sustained due to unauthorized equipment modifications or use of parts not specified by Associated Research. Instruments returned to Associated Research with unsafe modifications will be returned to their original operating condition at your expense.

TEST STATION

Location

Select an area out of the main stream of activity. Preferably, it should be a room which employees do not walk through in performing their normal duties. If this is not practical because of production line flow, then the area should be marked for HIGH VOLTAGE TESTING and roped off and no employees other than the test operators should be allowed inside.

If benches are placed back-to-back, be especially careful about the use of the bench opposite the test station.

Power

Dielectric Voltage Withstand Test Equipment must be connected to a good ground. Be certain that the power wiring to the test bench is

©Associated Research, Inc.

properly polarized and that the proper low resistance bonding to ground is in place. Some testers incorporate monitor circuits which check the connections to the power line and ground. The lights on these line monitors show at a glance if the wiring is correct or if the polarity is wrong, ground missing, etc. Turn off and unplug the equipment, and do not use it until the wiring is repaired if anything other than an OK signal is given.

Power to the test station should be arranged so that it can be cut off by a single, prominently located and marked switch at the perimeter of the test area. In the event of an emergency, any responsible employee can cut off the power before entering the test area to offer assistance.

Work Area

Perform the tests on a nonconducting table or workbench, if possible. If you must use a conductive surface, be certain that it is securely grounded to a good earth ground and insulate the high voltage connection from the grounded surface. Any metal which is in the area should not be between the operator and the area where products being tested will be placed, and the metal should be connected to a good ground, never left "floating".

The tester should be placed off to the side so that the operator does not have to reach over the product being tested to activate or adjust the tester.

Keep the area clean and uncluttered. All test equipment and test leads not absolutely necessary for the test should be put away and not left on the test bench. It should be clear to both the operator and to any observers which product is being tested, which ones are waiting to be tested or have already been tested.

Do not perform Hipot tests in a combustible atmosphere or in any area where combustible materials are present.

TEST OPERATOR

Qualifications

This instrument generates voltages and currents which can cause harmful or fatal electric shock and must only be operated by skilled workers trained in its use.

The operator should understand the electrical fundamentals of voltage, resistance, and current. They should recognize that the test instrument is a variable high-voltage power supply with the return lead directly connected to earth ground and therefore,

Hypot® is a Registered Trademark of Associated Research, Inc.

current from the high-voltage output will flow to any available ground path.

Safety Procedures

Operators should be thoroughly trained to follow these and all other applicable safety rules and procedures before they begin a test. Defeating any safety system should be treated as a serious offense and should result in severe penalties, such as removal from the Hipot testing job. Allowing unauthorized personnel in the area during a test should also be dealt with as a serious offense.

Dress

Operators should not wear jewelry which could accidentally complete a circuit.

Medical Restrictions

This instrument should not be operated by personnel with heart ailments or devices such as pacemakers.

TEST PROCEDURES

Plug in the high voltage test lead only when it is being used. Handle its clip only by the insulator---never touch the clip directly. Never touch the item being tested during the Hipot test. When you are not actively performing tests, and before leaving the test station, unplug the high voltage test lead from the Hipot. When performing tests using the high voltage receptacle, remove and store the high voltage test lead away from the front of the Hipot.

Connect the return (ground) lead first for any test. It should be connected to the return jack on the Hipot and then to the exposed metal parts of the item being tested. This is true regardless of whether you are testing a sample of insulating material using electrodes, a component using the high voltage test lead, or a cord-connected device with a two or three prong plug.

When connecting a line cord and plug to the high voltage receptacle, be certain that the other end is connected to the device to be tested. The return lead should already be connected before you plug the cord into the Hipot.

When turning on the Hipot, activate the POWER ON switch only. Check the line monitor on the front panel. Its lamps should indicate that the power receptacle the instrument is plugged into is properly polarized and grounded (OFF-ON-ON). See page 19. If not, turn off the Hipot, disconnect it and do not use it until its power source is properly polarized and grounded.

©Associated Research, Inc.

Be certain that you have control over any remote test switches connected to the Hipot.

If you are testing an item with a three-prong plug, always use the ground continuity test first to check the grounding wire of the cord and its connection to the exposed metal of the device under test.

Before pressing the Test switch or activating a remote test switch, double check the return (ground) and high voltage connections to be certain that they are proper and secure. Never touch the item under test or anything connected to it during a test.

Perform tests on a non-conducting table or workbench, if possible. If you must use a conductive surface, be certain that it is securely grounded to a good earth ground and properly insulate the high voltage connection from the grounded surface.

!NEVER ATTEMPT TO HIPOT TEST ENERGIZED CIRCUITRY OR EQUIPMENT!

Hypot® is a Registered Trademark of Associated Research, Inc.

WHY PERFORM DIELECTRIC WITHSTAND TESTS

A dielectric withstand test is a deliberate application of a higher than normal potential across some insulating material or the entire insulation system of a component or device. This stresses the insulation and the intent is to verify that the insulation can withstand this stress without breaking down (arcing) and without drawing excessive leakage current.

If the insulation passes this test, it is assumed that it will withstand the lesser stress of its intended application. The test can uncover defects in material or workmanship which would render the insulation system ineffective if not corrected and could result in a potentially unsafe product.

The items most commonly subjected to dielectric withstand tests fall into four categories:

1. **Insulating raw materials:** solids, liquids, gases.
2. **Components:** switches, relays, transformers, circuit breakers, potentiometers, wire cable, connectors, etc.
3. **End Products:** appliances, motors, instruments, office machines, the control equipment of aircraft, power tools, etc.
4. **Repaired or rebuilt products:** rewound motors, generators, transformers, repaired appliances and entertainment devices.

The majority of the tests performed can be grouped into the following categories:

1. **Design Tests:** A manufacturer can conduct laboratory tests to check the insulation designed into his product or purchased from an outside supplier. These tests measure the dielectric properties of the material when subjected to the high voltage conditions specified by the manufacturer or supplier. These tests can also gauge the relative insulating quality of competing products during component selection.
2. **Routine Production Tests:** A manufacturer can conduct tests at various points in the production of his products to uncover defects in material or workmanship and take corrective action before the defective product receives further processing. Regulatory agencies or independent testing labs will often

©Associated Research, Inc.

require specific tests on completed products immediately prior to packaging for shipment. The products must pass these tests as a condition for "listing" or "recognition" or "certification" or even for permission to offer the product for sale.

3. **Acceptance Tests:** A buyer can conduct tests on purchased components to prove that they meet minimum insulation specifications to prevent faulty components from being incorporated into their products.
4. **Service or Maintenance Tests:** Maintenance personnel responsible for electrical machinery and tools Hipot test their equipment to check the integrity of its insulation system. Periodic testing reveals whether or not deterioration has taken place and its extent.

Service companies such as motor rebuilders and appliance repairers perform Hipot tests after repairing equipment as a safety check to verify that they have done the work properly and have not degraded the product's insulation system.

TYPICAL APPLICATIONS

To insure that the insulation or insulation system is properly stressed during a dielectric withstand test, the voltage must be applied across the insulation. This is NOT the same connection as is normally used to power up the device being tested.

The voltage used and the time for which it is applied are usually specified by the manufacturer of an insulating material or by a regulatory or testing agency. When they are not, the test is often performed for 60 seconds at twice the normal operating voltage, plus 1000 volts. For example, a household iron rated at 120V would normally be tested at 1240V for one minute.

Application of the test voltage to each category of the items most commonly subjected to dielectric withstand tests is discussed below:

1. **Insulating raw materials:** The test voltage is applied to the test sample by placing the sample between two metallic electrodes connected to the Hipot output. The size and shape of the electrodes must be proper for the type and amount of material being tested. For testing liquids or gases, suitable

Hypot® is a Registered Trademark of Associated Research, Inc.

containers must also be used. Refer to your specific test specifications for test fixturing information.

2. **Components:** The test voltage is applied between parts which are normally conducting and parts which are normally isolated and nonconducting or grounded. For example, in testing a potentiometer, the three potentiometer terminals would normally be shorted together and connected to the high voltage lead, and the case of the potentiometer would be connected to the return lead. Some components such as motors and transformers require additional tests between two normally conducting parts which must be insulated from each other. For example, a simple transformer would be tested primary to secondary in addition to being tested primary to core and secondary to core.

When testing transformers, it is a common practice to connect both ends of a winding to the high voltage. It is not the continuity of the winding which is being tested, but the insulation from every part of the winding to other components of the transformer. A similar technique is used to test any winding, coil or heating element in a component, because overstressing these parts is not generally part of the Hipot test.

Switches and relays are tested from contacts to insulation and across open contacts. A special electrode may be required to test the insulation of resistors, capacitors and similar items encapsulated by a coating or molded case. The special electrode, touching the outside of the coating or case, is one connection point. The other is the device leads, all shorted together.

3. **End products:** These are typically line-cord connected finished products. The double-insulated variety must be tested with special electrodes touching the outside of the case connected to the return (ground) lead of the Hipot and BOTH blades of the line cord connected to the high voltage lead of the Hipot. Any device with metal parts on its exterior should have the return (ground) lead connected to those metal parts (all connected together at once, or sequentially) and the high voltage applied to BOTH blades of the line cord.

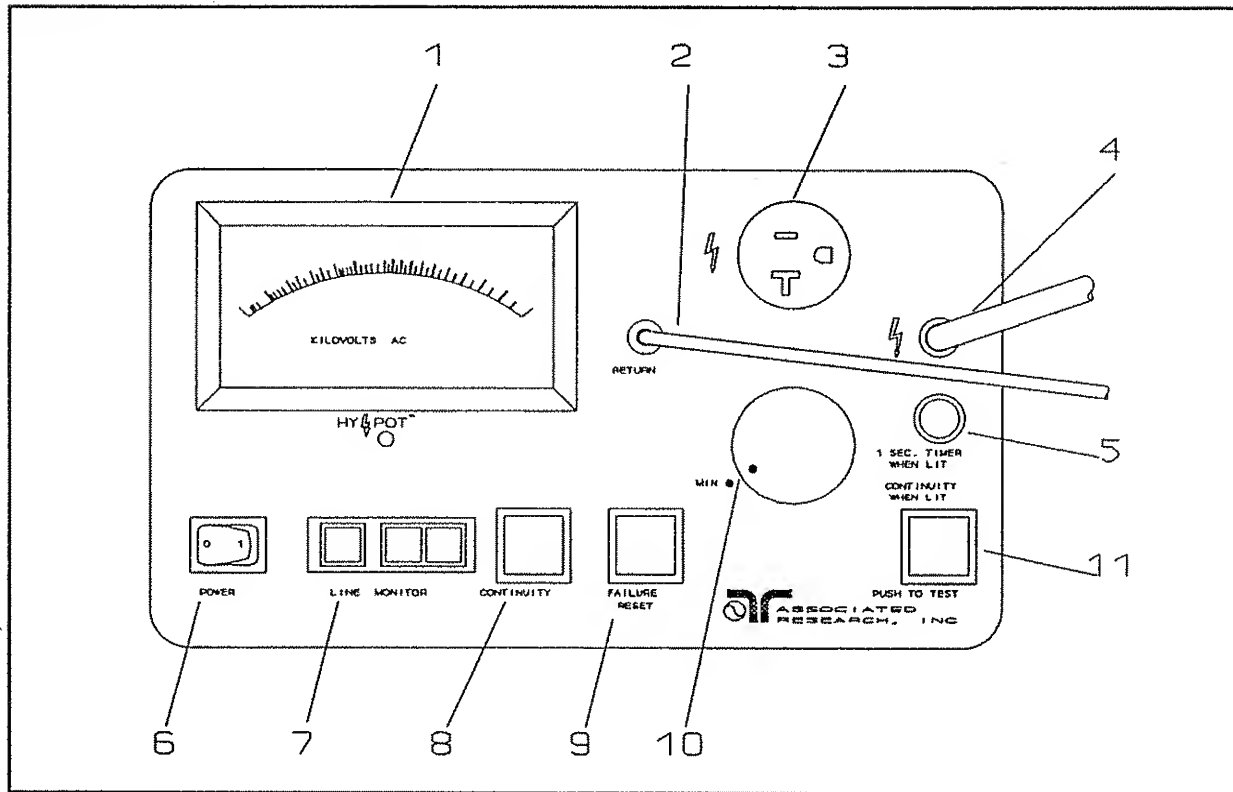
When testing cord-connected end products, always leave the power switch on so that the entire line circuit will be tested. If the device does not have a neutral connection, and

the ground connection normally carries a current, it will fail a Hipot test from line to ground unless the connection from the internal wiring to ground is temporarily lifted during the test. Combination 115-230V appliances are often of this nature.

4. **Repaired or rebuilt products:** The same techniques are generally used as on new equipment, except that the test voltage or time is sometimes reduced.

Hypot® is a Registered Trademark of Associated Research, Inc.

FEATURES OF MODELS



FRONT PANEL FEATURES

1. **Kilovoltmeter.** Wide, easy to read 4½ inch meter movement with $\pm 2\%$ full scale accuracy.
2. **Detachable 5 foot (1.52 m) Return (ground) Lead.** This lead is always used in making a test. It is grounded for safety during the test. When testing a device with a three-wire cord, continuity is measured between the device's chassis ground pin and the return lead. Unlike other testers, it is possible to perform a reliable ground continuity test on a device which is grounded in its installation, such as a submersed pump or under-sink waste disposer.
3. **Receptacle for Testing Cord-connected Devices.** The line and neutral terminals of this receptacle are BOTH connected to the high voltage output. The ground terminal is isolated from

©Associated Research, Inc.

ground if the Continuity Test switch is ON, and connected to ground if the Continuity Test switch is OFF.

4. **Detachable 5 foot (1.52 m) High Voltage Lead** for testing devices without a line cord. The silicone rubber insulation is flexible for easy handling and is rated at 30KVDC. The jack is recessed for safety when this lead is not in use.
5. **One Second Timer Indicator Lamp.** Illuminates when the one second test timer switch on rear panel is in its ON position.
6. **Rocker-style Power Switch** with international ON (1) and OFF (0) markings.
7. **Line Safety Monitor** shows the condition of the power receptacle to which the Hipot is connected. Proper grounding is essential for safety while performing Hipot tests. Therefore, the Hipot must not be used unless its power receptacle is properly grounded. The line monitor should be checked every time the Hipot is turned on. It should indicate a safe power-on condition. Any other indication represents a dangerous condition and the Hipot must not be used until the trouble is corrected. See page 19.
8. **Continuity Test On-Off Switch.** When testing devices with a three-wire line cord, this switch should be in its ON position (illuminated). First connect the return lead to the exposed metal of the device. Then, as the line cord is plugged into the high voltage receptacle, the continuity light in the Test switch should illuminate, indicating that there is continuity from the ground pin of the plug to the exposed metal.

If this does not happen, there is no continuity. Pressing the Test Switch will not apply high voltage, the Red Failure indicator will illuminate and the audio alarm will sound. To reset the system for the next test, press and release the Reset switch.

When testing items without a three-wire line cord the continuity switch should be in its OFF position (not illuminated).

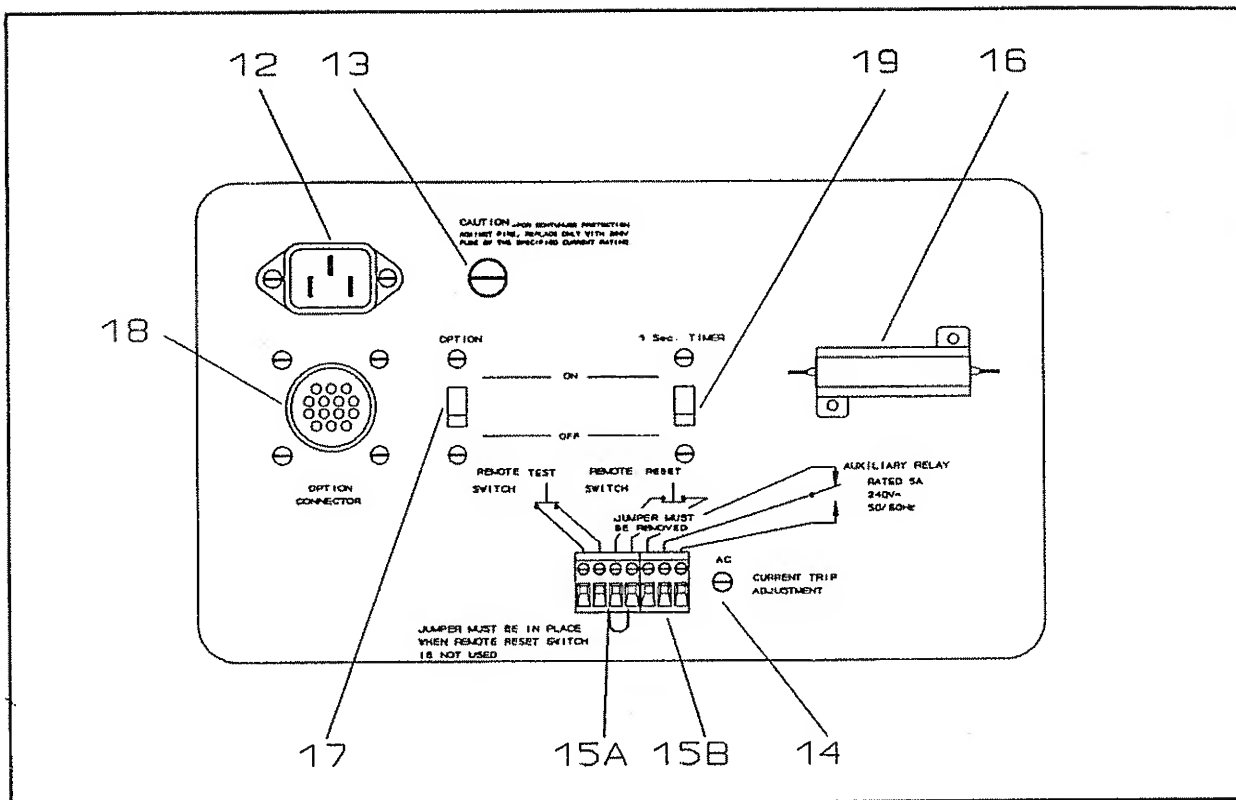
9. **Failure Indicator and Reset Switch.** If ground continuity is lost or if excessive leakage current is drawn during the Hipot test, the high voltage will shut off, the red Failure indicator will illuminate and the audio alarm will sound. To

Hypot® is a Registered Trademark of Associated Research, Inc.

reset the system for the next test, press and release the Reset switch.

10. **Voltage Adjust Knob.** This control varies the high voltage output from near zero to the rated output potential. Zero crossover is used to minimize turn-on voltage spikes. The voltage can be adjusted only when the Test switch is depressed. Therefore, if the setting is unknown, either check it with the test leads disconnected or return it to zero before pressing the Test switch. Some types of testing require gradual application of the test voltage. In these cases, it is possible to press the Test switch and increase the voltage with one hand. Other types of tests allow the test voltage to be preset. In these cases, the setting may be left undisturbed and when the Test switch is pressed, the entire voltage will be applied. The voltage should be monitored by observing the meter as line voltage or tested load fluctuations will cause it to vary.
11. **Continuity Indicator and Test Switch.** When testing devices with three-wire line cords, this lamp indicates whether or not there is continuity between the chassis ground pin and the exposed metal on the device. If there is no continuity, pressing the Test switch will not apply the high voltage, the Red Failure indicator will illuminate and audio alarm will sound. To reset the system for the next test, press and release the Reset switch.

If there is continuity, or if the continuity switch is OFF, pressing the Test switch activates the high voltage output of the Hipot.



REAR PANEL FEATURES

12. **Standard IEC 320 connector** with detachable 7½ foot (2.29 m) power cord.
13. **Line Fuse** accessible from the rear. "Shock safe" fuse holder.
14. **Current Trip (sensitivity) Adjustment.** The leakage current trip point which triggers the failure alarm is adjustable from .75 mA to 15 mA on AC models and .75 mA to 5 mA on DC models. Turn the control counterclockwise to lower the current trip point and increase sensitivity. Turn it clockwise to raise the current trip point and decrease sensitivity.
- 15A. **Remote Switch Connections.** Terminals are provided to connect a remote Test switch and a remote Reset switch. The Test switch must be a momentary contact Normally Open switch. It could be a foot switch, or relay contacts in an automatic test system. The Reset switch must be a momentary contact Normally Closed switch. **THE JUMPER MUST BE REMOVED FROM THE TERMINALS**

Hypot® is a Registered Trademark of Associated Research, Inc.

WHEN THE REMOTE SWITCH IS CONNECTED AND REPLACED WHEN THE REMOTE SWITCH IS DISCONNECTED.

- 15B. **Auxiliary Relay Connections.** The auxiliary relay actuates simultaneously with the Failure indicator and audio alarm. It is reset by the Reset switch. SPDT contacts are brought to the terminal strip for connection to an automatic reject device, automatic test system, or to a remote failure indicator. The contacts are rated 5A max, 240VAC, 50/60 Hz.
16. **Optional Calibration Resistor.** A 120K ohm $\pm 1\%$ resistor used to calibrate or check the sensitivity setting when this value is specified to be used.
17. **Option Switch.** Used to disable or enable an option which is connected to the option connector. The switch must be in the ON position when an option is connected. The switch must be in the OFF position when no options are in use or the Hipot will not operate.
18. **Option Connector.** Various options, such as a dwell timer, ramp and dwell system, auto-reset, or automatic test sequencer, may be connected here.
19. **One Second Timer Switch.** This switch enables the one second timer in the ON position and disables the timer in the OFF position.

PERFORMING CONTINUITY TESTS

The continuity test is done to insure that a low resistance path exists between the equipment chassis and the safety ground pin of the line cord. If a live wire inside the equipment came loose and contacted the chassis, the fault current would flow through the low resistance safety ground, protecting the user.

When testing equipment with three-wire line cords follow the steps below:

1. Set the Continuity Switch to the ON position (illuminated).
2. Connect the return lead of the Hypot® to the chassis of the device under test.
3. Plug the three-wire line cord into the high voltage receptacle.
4. If continuity is GOOD, the green Continuity Good indicator inside the Test Switch will light. Proceed with the hipot test by pressing the Test Switch.

Continuity is continuously monitored during the hipot test. If continuity is lost while the test is in process, the high voltage will shut off, the Red Failure Indicator will light, and the audio alarm will sound. Press the Reset Switch to clear the failure and reset the system for the next test.

5. If continuity is BAD, the green Continuity Good indicator will not light. Pressing the Test Switch will not apply high voltage, the Red Failure Indicator will light, and the audio alarm will sound. Press the Reset Switch to clear the failure and reset the system for the next test.

Hypot® is a Registered Trademark of Associated Research, Inc.

PERFORMING MANUALLY OPERATED TESTS

1. Locate the Hipot in an isolated location where adequate light and power are available. Allow enough room around the device to be tested to make straightforward and uncrowded connections and to insure that all personnel will be able to stay clear during the tests.

The table or bench should be nonconducting. If a conductive surface must be used, it should be securely grounded to a good earth ground, and the high voltage connection must be insulated from ground.

2. Be sure the power switch is OFF. Install and connect the line cord and turn the Power switch ON. Check the Line Monitor. If it indicates Power On (OFF-ON-ON), the power receptacle is wired properly. For any other indication, turn the Hipot off, disconnect it, and do not use it at that location until the problem is corrected. See page 19 for an explanation of the line monitor graphics.
3. Connect the return lead to the Hipot and to the item to be tested. If the high voltage lead is to be used, connect it to the Hipot and to the item to be tested. If a cord-connected device is to be tested, plug it into the high voltage receptacle and set the Continuity Test switch to ON for a three-wire line cord or OFF for a two-wire line cord or other device.
4. Rotate the voltage control fully counterclockwise. Press and hold the Test switch and rotate the voltage control until the desired test voltage is reached. **NEVER TOUCH THE DEVICE UNDER TEST WHILE HIGH VOLTAGE IS PRESENT.** When the desired test voltage is reached, start timing the test. Hold the switch until the desired test time has elapsed, then release the switch.

If there has not been any failure indication, the item has passed the Hipot test. If ground continuity is lost or if excessive leakage current is drawn during the Hipot test, the high voltage will shut off, the red Failure indicator will illuminate and the audio alarm will sound. To reset the system for the next test, press and release the Reset switch.

5. Verify that the high voltage has dropped to zero by observing the meter. HOT STICK probes (see NOTE below) can be used to discharge any capacitance as a further safety precaution. Then the item tested can be disconnected and the next item connected for testing. If the test voltage can be applied all at once, then the voltage control setting can be left alone and testing is accomplished by pressing and holding the Test switch while monitoring the voltage on the meter. If the voltage must be applied gradually, step #4 must be repeated.

NOTE: A hot stick is a nonconducting rod about two feet long with a metal probe at the end which is connected to a wire. To discharge the device under test, two hot stick probes are required. First connect both probe wires to ground. Then touch one probe tip to the same place the return lead was connected. While holding the first probe in place, touch the second probe tip to the same place where the high voltage lead was connected. Again, check the meter to be sure the voltage has dropped to zero.

PERFORMING ONE SECOND TIMER TESTS

1. Locate the Hipot in an isolated location where adequate light and power are available. Allow enough room around the device to be tested to make straightforward and uncrowded connections and to insure that all personnel will be able to stay clear during the tests.

The table or bench should be nonconducting. If a conductive surface must be used, it should be securely grounded to a good earth ground, and the high voltage connection must be insulated from ground.

2. Be sure the power switch is OFF. Install and connect the line cord and turn the Power switch ON. Check the Line Monitor. If it indicates Power On (OFF-ON-ON), the power receptacle is wired properly. For any other indication, turn the Hipot off, disconnect it, and do not use it at that location until the problem is corrected. See page 19 for an explanation of the line monitor graphics.
3. Connect the return lead to the Hipot and to the item to be tested. If the high voltage lead is to be used, connect it to the Hipot and to the item to be tested. If a cord-connected device is to be tested, plug it into the high voltage receptacle and set the Continuity Test switch to ON for a

Hypot® is a Registered Trademark of Associated Research, Inc.

three-wire line cord or OFF for a two-wire line cord or other device.

4. Place the One Second Timer Switch and Option Switch into their OFF positions. Rotate the voltage control fully counter-clockwise. Press and hold the Test switch and rotate the voltage control until the desired test voltage is reached. NEVER TOUCH THE DEVICE UNDER TEST WHILE HIGH VOLTAGE IS PRESENT. When the desired test voltage is reached, release the Test switch.
5. Place the One Second Timer Switch in its ON position. The One Second indicator lamp will be illuminated on front panel.
6. Press and release the Test switch. High voltage will be applied to the device under test for ONE SECOND at the preset voltage of step #4.

If there has not been any failure indication, the item has passed the Hipot test. If ground continuity is lost or if excessive leakage current is drawn during the Hipot test, the high voltage will shut off, the red Failure indicator will illuminate and the audio alarm will sound. To reset the system for the next test, press and release the Reset switch.

7. Verify that high voltage has dropped to zero by observing the kilovoltmeter and using a HOT STICK (see page 17). The item tested can then be disconnected and the next item connected for testing. If the test voltage can be applied all at once, then the voltage control setting can be left alone and testing is accomplished by depressing Test switch while monitoring voltage on meter. If voltage must be applied gradually, ONE SECOND TIMER should be disabled (switch off) and manual operating instructions must be followed as listed on page 16.

LINE MONITOR "DO NOT OPERATE" CONDITIONS

One of the "DO NOT OPERATE" conditions of the line monitor on the front panel will appear whenever a combination of improper or missing connections occurs in the input line cord to the Hipot tester.

The following shows the various combinations of lights and explains what causes them:

□ = Light Off

■ = Light On

□ ■ ■ Power condition good.

□ ■ □ Open ground (ground wire is not connected to Hipot).

■ □ ■ DO NOT TOUCH THE TESTER!
Lights indicate one of the following:

1. Open neutral.
2. Reversed polarity hot open (hot applied to neutral and either no connection to hot terminal or power switch off.)
3. Hot and ground reversed.

Note: This combination will be seen whether the power switch is on or off.

■ ■ □ Reversed polarity.

Hypot® is a Registered Trademark of Associated Research, Inc.

CURRENT TRIP (SENSITIVITY) ADJUSTMENT

The failure detector is preset at the factory to 5 mA for AC models or 1 ma for DC models. If this setting is not appropriate for your intended application, it can be reset as follows:

1. Two resistors are recommended for use in adjusting the sensitivity. R_b may be called out in the testing requirements, or may be calculated as follows:

$$\frac{\text{Voltage at which the test is being made}}{\text{Minimum current which must trigger a failure}} = R_b$$

After the sensitivity is properly adjusted, resistor R_b must always fail. R_b should be a single resistor or a combination of resistors as close to the calculated value as possible, with a tolerance of 1% or better. R_g is chosen to be approximately 5% more than R_b ($1.05 \times R_b$). The closest standard value should be used. There is no need for the value of R_g to be very precise.

If a looser tolerance resistor (more than 2%) is used for R_g , an ohmmeter should be used to verify that R_g is indeed approximately 5% higher than R_b . After the sensitivity is properly adjusted, resistor R_g must always pass. Both R_b and R_g should be rated to handle the power they will be dissipating $[(\text{Test voltage})^2 \div R_b]$

2. The voltage should be set using R_g . This will produce the maximum load on the Hipot. The voltage decreases somewhat with load, so when testing a good unit or with no load, the voltage will be more than what is specified. However, in no case should it rise by more than 20%.
3. When R_b is tested, the alarm should sound. It may not begin immediately, but it should start within half a second after the voltage reaches the vicinity of the specified test voltage. If the alarm does not sound, adjust the current trip control a small amount counterclockwise and repeat the test. If the alarm sounds when R_g is tested, adjust the control a little clockwise and repeat the test. Holding the Test switch while adjusting the control does not produce acceptable results.

4. When the setting is close to being correct, recheck the voltage setting using R_g . There is some interaction between the sensitivity setting and the voltage control. If it is desired, the voltage can be set somewhat higher than the specified test voltage, to account for line voltage fluctuations during the day. Recheck with no load to be sure that the voltage does not exceed 120% of the specified test voltage.
5. The sensitivity setting must be fine tuned so that R_g always passes and R_b always fails. Wait approximately ten seconds between successive tests when testing manually. This will allow the neon-lamp photocell failure detector to recover and it will take less time to achieve repeatability.
6. When doing automatic testing, the tests should always be done at the normal speed. This should ensure consistent timing between tests, and approximate normal operation. Prepare a mix of marginally good units containing a resistance of value R_g instead of their normal contents, and marginally bad units containing a resistance of R_b instead of their normal contents.

Mark them clearly GOOD and BAD. If all good units pass, and some bad units pass, adjust slightly counterclockwise and run the samples through again. If all bad units fail and some good units fail, adjust slightly clockwise and run the samples through again. If some good units fail and some bad units pass, check the difference in resistance between the two types.

It could be that the failure system cannot distinguish a small resistance differential. If the differential is 5% or more and repeatability still cannot be obtained, it could be that the failure detector cannot keep up with the speed of the equipment. Try it at a lower speed if possible.

7. Retain the set of marginally good and marginally bad units, or resistors R_b and R_g to check and readjust the sensitivity setting at a later date. Set up a schedule to do this periodically.

Hypot® is a Registered Trademark of Associated Research, Inc.

SPECIFICATIONS

| | | | | | | | | |
|---------------------|---|--------------------|---------------------|--|---------------------|--------------------|---------------------|--------------------|
| MODELS | 4040AT | 4050AT | 5060AT | 4040AX | | 4050AX | 5060AX | |
| DESCRIPTION | HYPOT® AND GROUND CONTINUITY TEST SET | | | | | | | |
| INPUT | 120 VAC, 50/60 HZ, SINGLE PHASE, 1AMP. | | | 230 VAC, 50/60 HZ, SINGLE PHASE, .5AMP | | | | |
| OUTPUT VOLTAGE | 0-3 KVAC | 0-5 KVAC | 0-6 KVDC | 0-3 KVAC | | 0-5 KVAC | 0-6 KVDC | |
| | CONTINUOUSLY ADJUSTABLE. ZERO-CROSSING TURN ON. NO TRANSIENTS EXCEEDING 120% OF PEAK VALUE. | | | | | | | |
| OUTPUT CURRENT | 0-15 mA AC | OPTIONAL 0-25 | 0-15 mA AC | 0-5 mA DC | 0-15 mA AC | OPTIONAL 0-25 | 0-15 mA AC | 0-5 mA DC |
| TRIP CURRENT RANGE | .75-15 mA AC | OPTIONAL .75-25 | .75-15 mA AC | 0-5 mA DC | .75-15 mA AC | OPTIONAL .75-25 | .75-15 mA AC | .75-5 mA DC |
| PRESET TRIP CURRENT | 5mA AC | | | 1mA DC | 5mA AC | | | 1mA DC |
| DUTY CYCLE | CONTINUOUS | | | | | | | |

PRIMARY APPLICATION Manufacturing and production line testing of commercial and consumer products to meet UL, CSA, VDE, BSI, and IEC requirements where dielectric withstand and ground continuity tests are specified.

METERING Analog kilovoltmeter with 50 volt reading resolution connected directly across the output terminations. Accuracy $\pm 2\%$ of full scale. Tracking $\pm 2\%$ of full scale.

LINE CORD Detachable 7½ foot (2.29m) input power cable terminated in a three prong grounding plug (AT Models) or as specified (AX Models).

HIGH VOLTAGE & RETURN / CONTINUITY TERMINATIONS High voltage three prong isolated grounding type receptacle allows device under test to be plugged directly into the dielectric withstand tester. Also equipped with removable five foot (1.52 m) high voltage return/continuity leads.

SIZE [W H D] 10.87" X 6.25" X 10.75" (276.2 X 158.7 X 273.0 mm)

WEIGHT 15.8 lbs (7.16 Kg)

©Associated Research, Inc.

LINE SAFETY
MONITOR

A safe power-on indicator monitors input power and warns against malfunctions in the grounded 3-wire 120 volt AC receptacle to which the equipment is connected.

FAILURE
DETECTOR

Audible and visual indication of unacceptable performance. In addition, auxiliary relay contacts (SPDT) transfer when failure is detected. Failure detection system remains activated until manually reset.

Failure is detected with a current sensitive overload system monitoring current in the return side of the output and an RF detector which responds to breakdown or arcing condition. The failure detector is factory set as shown in the above table. The failure detector setting may be easily reset if desired.

CONTINUITY
TEST

Ground continuity test between chassis grounding conductor and exposed dead metal parts performed automatically, regardless if equipment to be tested is grounded or not by some other means, while making connections for Hipot test.

Ground continuity indicated by glow of the lamp in the Test switch. If there is no continuity and the yellow continuity switch is in the ON position, pressing the Test switch will not apply high voltage. Instead, the Red Failure indicator will light and the audio alarm will sound.

Hipot test may be performed on items which do not require the continuity test by putting the ground continuity test switch in the OFF position.

ONE SECOND
TIMER

Allows one second timing and termination of Hipot tests. Timer is activated when timer switch is in the ON position and the Test switch is depressed.

OPTIONAL
CALIBRATION
RESISTOR

120K ohm 1% resistor located on the rear panel is provided for the user to set sensitivity of the failure detector in accordance with Agency specifications.

OPTION
CONNECTOR

Various options, such as a dwell timer, ramp and dwell, auto-reset, may be connected here.

Hypot® is a Registered Trademark of Associated Research, Inc.

AVAILABLE
OPTIONS

Rear Output Jacks (Use AR suffix after Model#).
SAFE-T Probe™.....Part# 36402.
Black Stationary Probe.....Part# 35539.
120K OHM Calibration Kit.....Part# 35534.
4-15 Second Ramp 1-99 Second Dwell Part# 35536.
1-5 Second Ramp 1-99 Second Dwell..Part# 35666.
Foot SwitchPart# 35822.
1-99 Second Dwell Timer.....Part# 35535.
Adjustable Resistor Bank.....Part# 36101.

INTERNATIONAL
MODELS

Models with the AX suffix denote international versions of our standard AT models. These AX versions come with 220-240 VAC line power and fuses. They may be ordered with an optional HV ADAPTOR BOX that has the electrical receptacle of the specific country you require. For example, BS1363 FOR BRITAIN, C-112 FOR AUSTRALIA, CEE 7-4 FOR GERMANY.

TROUBLESHOOTING HINTS

| SYMPTOM | CHECK |
|--|--|
| My instrument will not power up. | <ol style="list-style-type: none">1. Check that the line cord is plugged in.2. Check for a tripped line circuit breaker.3. Check that instrument fuse is in correctly and not blown.4. Check that Power Switch #6 is in the ON position.5. Check for proper line voltage. |
| I have an option plugged into the option connector #18, but it will not function. | <ol style="list-style-type: none">1. Check to be sure the option switch #17 on the rear panel is in the ON position.2. Check to see if the Remote Reset jumper is in place on the rear panel terminal block #15A.3. Check to be sure the One Second Timer switch #19 is in the OFF position. |
| I have a three wire line cord terminated product (grounded) plugged into the front panel receptacle #3 and my continuity light will not function. | <ol style="list-style-type: none">1. Check to be sure that the front panel continuity switch #8 is in the ON position.2. Check to be sure the return lead from the Hipot is connected to a metallic ground point on your test item. |
| I have a two wire line cord terminated product plugged into the front panel receptacle #3 and I get a failure indication as soon as I depress the Test switch #11. | <ol style="list-style-type: none">1. Be sure the continuity switch #8 is in the OFF (out) position. |

Hypot® is a Registered Trademark of Associated Research, Inc.

| SYMPTOM | CHECK |
|---|---|
| I have a remote reset device connected, but it will not function. | <ol style="list-style-type: none"> 1. Check to be sure the jumper is removed from the terminal block #15A as shown on the rear panel. 2. Check the remote reset device. It must be a normally closed contact. |
| I must test for a longer duration than 1 second, but I can't get my instrument to test for a longer duration. | <ol style="list-style-type: none"> 1. Check to be sure the 1 second timer switch on the rear panel #19 is in the OFF position. |
| I have connected a 120 K resistor to set my leakage trip point, but I cannot reach my required test voltage before my instrument indicates a failure. | <ol style="list-style-type: none"> 1. Adjust the current trip setting to a higher level until your required test voltage is reached. Then adjust the current trip point to it's proper setting. |
| I can't get high voltage to energize and I am not using an option. | <ol style="list-style-type: none"> 1. Check to be sure the option switch #17 is in the OFF position. 2. Check to see if the Remote Reset jumper is in place on the rear panel terminal block #15A. |
| The Hipot will not fail when the high voltage lead is shorted to the return lead when the high voltage is ON. | <ol style="list-style-type: none"> 1. Check the high voltage lead and the return lead for continuity. |

INDEX

| | |
|---------------------------------------|--|
| 120K ohm | 14, 24 |
| Acceptance Tests | 7 |
| Appliances | 6, 9 |
| Automatic testing | 21 |
| Auxiliary Relay connections | 14 |
| Breakdown | 23 |
| Calibration | 2, 14, 24 |
| Calibration Resistor | 14 |
| Components | 1, 2, 6-8 |
| Continuity | 1, 5, 8, 10-12, 15-18, 22-26 |
| Continuity indicator | 12 |
| Continuity Test | 1, 5, 10, 11, 15-17, 22-24 |
| Current Trip | 13 |
| Current Trip Point | 13, 26 |
| Design Tests | 6 |
| Dielectric Withstand Tests | 1, 6, 7 |
| Dress | 4 |
| Electric shock | 2 |
| End Products | 6, 8 |
| Failure | 11-16, 18, 20, 21, 23-26 |
| Failure Detector | 20, 21, 23, 24 |
| Failure indicator | 11 |
| Features | 1, 10, 13 |
| Ground | 1-5, 8-12, 15-19, 22-25 |
| High Voltage Lead | 8, 11, 16, 17, 26 |
| Hipot Test | 4, 5, 7-9, 11, 15, 16, 18, 23, 24 |
| Hot Stick | 17, 18 |
| Insulating raw materials | 6 |
| Insulation | 6-8, 11 |
| Leakage Current | 6, 11, 13, 16, 18 |
| Line Cord | 4, 8, 11, 15-19, 22, 25 |
| Line fuse | 13 |
| Line Monitor | 4, 11, 16, 17, 19 |
| Line safety monitor | 11 |
| Location | 2 |
| Making Connections | 23 |
| Manually Operated Tests | 16 |
| Medical Restrictions | 4 |
| Motors | 1, 6, 8 |
| One second timer | 14 |
| One Second Timer Tests | 17 |
| Option connector | 14 |
| Options | 14, 24 |
| Power | 2-4, 6-8, 11, 13, 16, 17, 19, 20, 22-25, 2 |
| Production Tests | 6 |

Hypot® is a Registered Trademark of Associated Research, Inc.

| | |
|--|--------------------------------|
| Receptacle | 4, 10, 11, 15-17, 23-25 |
| Relays | 8 |
| Remote Start | 23 |
| Remote Switch Connections | 13 |
| Repaired or Rebuilt Products | 6, 9 |
| Reset Switch | 11-16, 18 |
| Resistors | 20 |
| Return Lead | 3, 4, 8, 10, 11, 15-17, 25, 26 |
| Safety Precautions | 2 |
| Sensitivity | 20 |
| Service and Maintenance | 2 |
| Service Interval | 2 |
| Service or Maintenance Tests | 7 |
| Specifications | 7, 8, 22, 24 |
| Switches | 5, 6, 8, 23 |
| Test Operator | 3 |
| Test Operator | 4 |
| Test Station | 2-4, 2 |
| Test Switch | 5, 11-13, 15-18, 20, 23-25 |
| Transformers | 6, 8 |
| Trip Current | 22 |
| User Modifications | 2 |
| User Service | 2 |
| Voltage adjust knob | 12 |
| Work Area | 3 |

SECTION II

REPLACEMENT PARTS LIST

| | | |
|-----------------------------|------------------------|------------------|
| ASSOCIATED RESEARCH INC. | REPLACEMENT PARTS LIST | S/N 5382 TO 6229 |
| | | REVISION H |
| | MODELS 4040AT 4040AX | ECO 4502 |
| | | DATE 10-01-92 |
| | | PAGE 1 OF 3 |

| <u>SYM</u> | <u>PART #</u> | <u>DESCRIPTION</u> | <u>QTY</u> |
|--|---------------|-----------------------------------|------------|
| <u>4040AT, 4040AX COMMON PARTS (USED ON BOTH 120V AND 230V MODELS)</u> | | | |
| AL | 35506 | ALARM, PIEZO | 1 |
| C2 | 35216 | CAP. ELEC. 2200 MFD, 25V | 1 |
| C101,310 | 18301 | CAP. ELEC. 220 MFD, 35V -10% +75% | 2 |
| C301,303,304 | 35634 | CAP. FILM .01 MFD 50V 10% | 3 |
| C302,313 | 35635 | CAP. POLY FILM .1 MFD 100V 5% | 2 |
| C314 | 36673 | CAP.CERAMIC .1 MFD 50V | 1 |
| C401 | 35497 | CAP. FILM .0022 MFD 200V | 1 |
| D1,2,301 | 35214 | DIODE 1N4001 | 3 |
| D302 | 34513 | DIODE SIL 75PIV 10MA 1N4148 | 1 |
| EC1 | 36173 | CONN. EDGE 20 POS/40 CONT DIP | 1 |
| EC2,3 | 36172 | CONN. EDGE 15 POS/30 CONT DIP | 2 |
| I1 | 04040AT-09 | INDICATOR, LINE MONITOR ASSEMBLY | 1 |
| I2-4 | 35467 | LAMP INCANDESCENT 6.3V | 3 |
| I5 | 36271 | LAMP INCANDESCENT 6.0V RED | 1 |
| J1 | 36178 | CONN. SOCKET HEADER 24 POS. | 1 |
| J2 | 04040AT-13 | RECEPTACLE/JUMPER ASSEMBLY | 1 |
| J3 | 15495 | JACK, BANANA BLACK | 1 |
| J4 | 04040A-18 | JACK, HIGH VOLTAGE ASSEMBLY | 1 |
| J10 | 36230 | CONNECTOR HOUSING 15 CIRCUIT | 1 |
| J11 | 35526 | RECEPTACLE, SQUARE FLANGE | 1 |
| K101,105 | 35432 | RELAY SPDT 5VDC 5A | 2 |
| K103 | 35826 | RELAY 240VAC 3A SOLID STATE | 1 |
| K104,107, | 35434 | RELAY DPDT DIP 5VDC 2A | 4 |
| K110,111 | | | . |
| K106,108,301 | 35435 | RELAY REED SPST 5VDC SIP | 3 |
| L401 | 11155 | CHOKE 2.5 MH FIXED | 1 |
| M1 | 04040AI-24 | METER ASSEMBLY | 1 |
| P1 | 36177 | CONN. RECEPTACLE HOUSING 24 POS | 1 |
| P10 | 36174 | CONN. MALE 15 POST HEADER | 1 |

SCHEMATIC DRAWING: DS04040AT REV O

| | | |
|-----------------------------|------------------------|--|
| ASSOCIATED RESEARCH INC. | REPLACEMENT PARTS LIST | S/N 5382 TO 6229 REVISION H ECO 4502 DATE 10-01-92 PAGE 2 OF 3 |
| | MODELS 4040AT 4040AX | |

| <u>SYM</u> | <u>PART #</u> | <u>DESCRIPTION</u> | <u>QTY</u> |
|--------------|---------------|-----------------------------------|------------|
| P301 | 35473 | CONN. MALE 3 POST HEADER | 1 |
| R4 | 35446 | RES. FIXED 14.3M 1.25W | 1 |
| R5 | 35496 | RES. VAR. 2M 1/4W 10% | 1 |
| R7 | 35824 | RES. VAR. 250K 1W 10% | 1 |
| R101 | 36525 | RES. FIXED 200 OHM 1/4W 5% | 1 |
| R301,307 | 35628 | RES. FIXED 4.7K 1/4W 5% | 2 |
| R302 | 36244 | RES. VAR. 2M 1/4W 10% | 1 |
| R303 | 35645 | RES. FIXED 9.1M 1/4W 5% | 1 |
| R304,305,311 | 35630 | RES. FIXED 47K 1/4W 5% | 3 |
| R319 | 18926 | RES. FIXED 10K 1/4W 5% | 1 |
| R401 | 36281 | RES. FIXED 2K 2W 5% | 1 |
| R402 | 35494 | RES. VAR. 5K 3W 20% | 1 |
| R403 | 34878 | RES. FIXED 12.1K 1/2W 1% | 1 |
| S1 | 35440 | SWITCH SPST ROCKER | 1 |
| S2 | 35450 | SWITCH PUSH BUTTON DPDT ALT | 1 |
| (FOR S2) | 35452 | LENS YELLOW SQUARE | 1 |
| S3 | 36084 | SWITCH PUSH BUTTON DPDT MOMENTARY | 1 |
| (FOR S3) | 35453 | LENS GREEN SQUARE | 1 |
| S4 | 35449 | SWITCH PUSH BUTTON SPDT MOMENTARY | 1 |
| (FOR S4) | 35451 | LENS RED SQUARE | 1 |
| S5,6 | 35530 | SWITCH SLIDE 4PDT | 2 |
| T1 | 35454 | TRANSFORMER STEP DOWN | 1 |
| T2 | 35455 | TRANSFORMER HV 3KV 25MA | 1 |
| TP1,2 | 35644 | TERMINAL POINT MALE HEADER | 2 |
| TS1 | 35444 | TERMINAL STRIP 4 POLE | 1 |
| TS2 | 35443 | TERMINAL STRIP 3 POLE | 1 |
| U1 | 34935 | IC VOLTAGE REGULATOR LM340AT5 | 1 |
| U301 | 35576 | IC CMOS TIMER ICM7250 | 1 |
| U302 | 35578 | IC DRIVER 75451 | 1 |
| U304 | 37052 | IC CMOS QUAD NOR GATE 74HC02 | 1 |

SCHEMATIC DRAWING: DS04040AT REV O

| | | |
|-----------------------------|------------------------|--|
| ASSOCIATED RESEARCH INC. | REPLACEMENT PARTS LIST | S/N 5382 TO 6229 REVISION H ECO 4502 DATE 10-01-92 PAGE 3 OF 3 |
| | MODELS 4040AT 4040AX | |

| <u>SYM</u> | <u>PART #</u> | <u>DESCRIPTION</u> | <u>QTY</u> |
|---|---------------|----------------------------------|------------|
| U401 | 35505 | IC OPTOISOLATOR | 1 |
| VR401 | 35823 | VARISTOR 20MM 130V | 1 |
| | 04040A-08 | CABLE ASSEMBLY HIGH VOLTAGE | 1 |
| | 04040A-09 | CABLE ASSEMBLY RETURN | 1 |
| | 04040A-12 | JUMPER WIRE ASSEMBLY METER | 1 |
| | 04040AT-10 | INPUT RECEPTACLE ASSEMBLY | 1 |
| | 04040AT-14 | JUMPER ASSEMBLY RETURN JACK | 1 |
| | 04040AT-15 | HARNESS ASSEMBLY POWER SWITCH | 1 |
| | 04040AT-16 | OPTION CONNECTOR ASSEMBLY | 1 |
| | 04040AT-23 | JUMPER ASSEMBLY GROUND | 1 |
| | 04040AT-24 | JUMPER ASSEMBLY FUSE | 1 |
| | 33189 | CABLE INPUT CORDSET BLACK 7.5 FT | 1 |
| | 36021 | KNOB BLACK WITH DOT | 1 |
| | 36144 | FUSE HOLDER 1/4 X 1 | 1 |
| (FOR EC1) | 36710 | KEY POLARIZING | 1 |
| <u>4040AT UNIQUE PARTS (USED ONLY ON 120VAC MODELS)</u> | | | |
| F1 | 17755 | FUSE 1A 250V SLOW BLOW | 1 |
| | 36307 | FUSE CARRIER | 1 |
| R501 | 36268 | RES. FIXED 5K 10W 1% | 1 |
| T3 | 35441 | TRANSFORMER VARIABLE 0-120VAC | 1 |
| VR1 | 19840 | VARISTOR 130V | 1 |
| <u>4040AX UNIQUE PARTS (USED ONLY ON 230VAC MODELS)</u> | | | |
| F1 | 37045 | FUSE .5A 5 X 20 MM SLOW BLOW | 1 |
| | 36308 | FUSE CARRIER | 1 |
| R1-3 | 58309 | RES. FIXED 47K 1/2W 10% | 3 |
| T3 | 35757 | TRANSFORMER VARIABLE 0-240VAC | 1 |
| VR1 | 35758 | VARISTOR 250V | 1 |

SCHEMATIC DRAWING: DS04040AT REV O

SECTION III

CALIBRATION PROCEDURE

| | | |
|------------------------------|--|---|
| ASSOCIATED RESEARCH, INC. | <u>CALIBRATION PROCEDURES</u> MODEL NUMBERS 4040AT, 4040AX, 4050AT, 4050AX 5040AT, 5040AX, 5060AT, 5060AX | PROCEDURE # 36530 ISSUE DATE 03-03-87 REV # D REV DATE 08-27-90 PAGE 1 OF 6 |
|------------------------------|--|---|

NOTE: CMOS CHIPS ARE TO BE INSERTED IN ALL UNITS AFTER COMPLETION OF CALIBRATION PROCEDURES STEPS I, II, AND III.

NOTE: STATIC CONTROL SHOULD BE PRACTICED DURING STORAGE, HANDLING, AND CALIBRATION AFTER INSERTION.

NOTE: HYPOT® IS A REGISTERED TRADE MARK OF ASSOCIATED RESEARCH, INC.

I. HIPOT TEST:

Equipment needed: AC Hypot® Test Set Model 4040AT.

NOTE: LINE MONITOR MUST REMAIN DISCONNECTED UNTIL AFTER HIPOT TEST.

1. Connect line cord to input receptacle of the unit under test.
2. Connect input plug of the unit under test to High Voltage Receptacle of Hypot Test Set.
3. Connect return/continuity lead of Hypot Test Set to chassis of the unit under test.
4. Place Power Switch of the unit under test in "ON" position and adjust voltage control to its extreme counterclockwise position.
5. Place power switch of Hypot Test Set in "ON" position.
6. Place continuity test switch of Hypot Test Set in "ON" position.
7. Place one second timer switch of Hypot Test Set in "OFF" position.
8. Energize high voltage output of Hypot Test Set by depressing "Push to Test" switch on test set. (This will activate ground continuity test and apply high voltage if ground continuity is present.)

Slowly raise the output of Hypot Test Set for 1240 V for AT Series or 1500 V for AX Series. This is to be applied for one (1) second to the unit under test without electrical breakdown.
9. Release "Push to Test" switch on test set and return voltage control to its extreme counterclockwise position.
10. Connect HV output of Hypot Test set to AUX Relay outputs TS5, TS6, TS7 of unit under test.
11. Depress "Push to Test" switch on test set and slowly raise output to 1000 v. This is to be applied to the AUX Relay contacts for 1 second without electrical breakdown.

| | | |
|------------------------------|--|---|
| ASSOCIATED RESEARCH, INC. | <u>CALIBRATION PROCEDURES</u> MODEL NUMBERS 4040AT, 4040AX, 4050AT, 4050AX 5040AT, 5040AX, 5060AT, 5060AX | PROCEDURE # 36530 ISSUE DATE 03-03-87 REV # D REV DATE 08-27-90 PAGE 2 OF 6 |
|------------------------------|--|---|

12. Release "Push to Test" switch, return voltage control to its extreme counterclockwise position and disconnect test set from unit under test.
13. Connect line monitor to J1 on Mother Board accordingly:

Green J1-1
White/Blk J1-2
Black J1-4

II. KILOVOLT METER CALIBRATION

Equipment needed: Digital Kilovolt Meter 3-3/4 to 4-1/2 digit, $\pm .5\%$ of reading ± 1 digit.

| <u>MODELS</u> | <u>RANGE</u> |
|--------------------------------|--------------|
| 4040AT, 4040AX, 4050AT, 4050AX | 0-5KVAC |
| 5040AT, 5040AX, 5060AT, 5060AX | 0-6KVDC |

1. Connect standard AC kilovoltmeter to high voltage output of the unit under test.
2. Mechanical zero adjust the kilovoltmeter of the unit for zero. Tap meter to make it bounce and check to make sure it returns to zero. If not, readjust and repeat.
3. Rotate voltage control to extreme counterclockwise position and turn power switch to "OFF", option switch to "OFF", and One second timer switch to "OFF".
4. Plug unit into 115 VAC outlet (230 VAC for AX models) and turn power switch to "ON" position.
5. Observe line monitor for safe power on condition before proceeding.
6. Place continuity test switch in "OFF" position.
7. Depress Push to Test switch and rotate voltage control clockwise until the standard kilovoltmeter indicates the reading shown in the table below:

| <u>MODELS</u> | <u>READING</u> |
|----------------|----------------------|
| 4040AT, 4040AX | 3 KVAC ± 1 digit |
| 4050AT, 4050AX | 5 KVAC ± 1 digit |
| 5040AT, 5040AX | 4 KVDC ± 1 digit |
| 5060AT, 5060AX | 6 KVDC ± 1 digit |

8. Adjust calibration pot R-5 until the meter on the unit reads the same as the standard KV meter.
9. Check meter tracking on all major points. Tracking should be within 2% of full scale reading on each point.

| | | |
|------------------------------|--|---|
| ASSOCIATED RESEARCH, INC. | <u>CALIBRATION PROCEDURES</u> MODEL NUMBERS 4040AT, 4040AX, 4050AT, 4050AX 5040AT, 5040AX, 5060AT, 5060AX | PROCEDURE # 36530 ISSUE DATE 03-03-87 REV # D REV DATE 08-27-90 PAGE 3 OF 6 |
|------------------------------|--|---|

| <u>MODELS</u> | <u>TRACKING</u> |
|----------------|-----------------|
| 4040AT, 4040AX | ± 60 VAC |
| 4050AT, 4050AX | ± 100 VAC |
| 5040AT, 5040AX | ± 80 VDC |
| 5060AT, 5060AX | ± 120 VDC |

10. Release Push to Test switch and rotate voltage control to extreme counterclockwise position. Apply glyptol to R-5.

III. FAILURE DETECTOR CALIBRATION

Equipment needed: Digital Multimeter (DMM) with .5% or better accuracy and 10% high voltage load resistors as shown below:

| <u>MODELS</u> | <u>DMM RANGES</u> | <u>LOAD RESISTORS</u> |
|----------------|-------------------|-----------------------|
| 4040AT, 4040AX | 20 and 2 ma AC | 120K 50W, 2M 20W |
| 4050AT, 4050AX | 20 and 2 ma AC | 120K 50W, 2M 20W |
| 5040AT, 5040AX | 10 and 1 ma DC | 400k 50W, 2M 20W |
| 5060AT, 5060AX | 10 and 1 ma DC | 400K 50W, 2m 20W |

Set the DMM to the proper range for the model to be calibrated.

A. High End Current Adjust

1. Rotate resistors R402 to its extreme counterclockwise position and R-7 to its extreme clockwise position.
2. Connect high voltage lead from unit to one side of load resistor (120K for AC models and 400K for DC models).
3. Connect DMM in series with load resistor and connect return/continuity lead to DMM.
4. Depress Push to Test switch and rotate voltage control clockwise observing the DMM until it indicates the value shown below:

| <u>MODELS</u> | <u>READING</u> |
|--------------------------------|----------------|
| 4040AT, 4040AX, 4050AT, 4050AX | 15.5 mA AC |
| 5040AT, 5040AX, 5060AT, 5060AX | 5.5 mA DC |

5. Slowly rotate R402 (limit pot) clockwise until either Event A or B occurs:
 - A. The alarm sounds and the lamp in the Red Reset Switch illuminates. The high voltage should also be automatically de-energized.
 - B. R402 reaches its extreme clockwise position with no failure.

| | | |
|------------------------------|--|---|
| ASSOCIATED RESEARCH, INC. | <u>CALIBRATION PROCEDURES</u> MODEL NUMBERS 4040AT, 4040AX, 4050AT, 4050AX 5040AT, 5040AX, 5060AT, 5060AX | PROCEDURE # 36530 ISSUE DATE 03-03-87 REV # D REV DATE 08-27-90 PAGE 4 OF 6 |
|------------------------------|--|---|

6. Release Push to Test switch. For Event A, push reset switch to shut off alarm.
7. Recheck setting of limit pot R402 by rotating voltage control counterclockwise, then depress Push to Test switch to energize high voltage. Observe the DMM while rotating voltage control clockwise. The failure detector should not activate until the current meter exceeds 15 mA for AC or 5 mA for DC models. If not, readjust R402 very slightly clockwise and repeat this check.

B. .75 mA Current Range Check

1. Replace the load resistor from Part A with the 2M ohm resistor.
2. Rotate Voltage Control to fully counterclockwise position.
3. Rotate R-7 fully counterclockwise.
4. Depress Push to Test switch and slowly rotate voltage control clockwise observing current meter.
5. The Failure Detector should be activated before the current meter indicates .75 mA. When the failure detector is activated, release the Push to Test switch and depress the failure reset button. Then rotate voltage control to full counterclockwise position.

If the failure detector does not trip below .75 ma, replace optoisolator U401 (p/n 35505) and repeat steps III-A and III-B.

C. Failure detector Factory Setting

1. Replace 2M resistor with 400K resistor for AC models. For DC models, use 2M resistor.
2. Rotate voltage control to extreme counterclockwise position.
3. Rotate R7 fully clockwise.
4. Depress Push to Test switch and slowly rotate voltage control clockwise observing DMM until it indicates 5 milliamps for AC models or 1 milliamp for DC models.
5. Rotate R-7 slowly counterclockwise to set the current trip point. The alarm should sound and the lamp in the Red Reset switch should glow when the trip point is set. High voltage should also be automatically de-energized.
6. Release Push to Test switch and push reset switch to shut off alarm.

| | | |
|------------------------------|--|---|
| ASSOCIATED RESEARCH, INC. | <u>CALIBRATION PROCEDURES</u> MODEL NUMBERS 4040AT, 4040AX, 4050AT, 4050AX 5040AT, 5040AX, 5060AT, 5060AX | PROCEDURE # 36530 ISSUE DATE 03-03-87 REV # D REV DATE 08-27-90 PAGE 5 OF 6 |
|------------------------------|--|---|

7. Recheck the trip point setting by rotating voltage control counterclockwise, then depress Push to Test switch to energize high voltage. Observe the DMM while rotating voltage control clockwise. The failure detector should activate when the current meter indicates $5 \text{ mA} \pm .1 \text{ mA}$ for AC models or 1 mA for DC models. If not, readjust R-7 very slightly and repeat this check.
8. Apply glyptol to R-402.

IV. ONE SECOND TIMER CALIBRATION

NOTE: STATIC CONTROL SHOULD BE PRACTICED FOR THE FOLLOWING CALIBRATION PROCEDURES.

Equipment needed: SANWA 8100LG Frequency counter-timer.

1. Remove One Second timer Daughter Board from Hypot unit.
2. Remove ICs from their static-controlled containers and insert into IC sockets accordingly:
 - U301 - #35576
 - U303 - #35577
 - U304 - #35615
3. With unit off, insert PCB back into unit card connector (EC-3) making sure traces line-up with connectors pins.
4. Connect J301 from wiring harness to P301 on one second timer board.
5. Place One Second timer switch to "ON", option to "OFF".
6. Connect unit line cord and plug into 115 V AC (230 V AC for AX models) outlet.
7. Place unit power switch in "ON" position. One Second Timer Indicator lamp should be continuously illuminated on front panel.
8. Connect line cord of frequency counter-timer to 115 V supply and set power switch to "ON".
9. Set frequency counter-timer for INTERVAL measurement.
10. Connect Red test lead into channel 1 and black test lead into channel 2.
11. Place channel 1 in INVERT mode. Place channel 2 in NONINVERT mode.
12. Place MANU/AUTO switch in MANU mode.
13. Place Red Time switch "IN" and Blue Frequency switch "OUT".

| | | |
|------------------------------|--|---|
| ASSOCIATED RESEARCH, INC. | <u>CALIBRATION PROCEDURES</u> MODEL NUMBERS 4040AT, 4040AX, 4050AT, 4050AX 5040AT, 5040AX, 5060AT, 5060AX | PROCEDURE # 36530 ISSUE DATE 03-03-87 REV # D REV DATE 08-27-90 PAGE 6 OF 6 |
|------------------------------|--|---|

14. Set range for 0.000 (sec.).
15. Connect Red and Black test clip together and connect to pin 1 of U301. Connect (-com) to TP2 of timer board.
16. Depress Push to Test switch and release. Test should start.
17. Observe frequency counter and adjust R302 for a reading of 1.000 to 1.010 seconds.
18. When the one second timer times out, the High Voltage will de-energizing.
19. Repeat steps 16 and 17 to assure that R302 is set to 1.000 to 1.010 seconds.
20. Rotate voltage control clockwise for a Voltage Reading of 2 KV.
21. Depress Push to Test switch and release. High voltage should be energized to 2 KV as indicated by kilovoltmeter on Hypot.
22. Check for frequency counter reading of 1.000 to 1.01 seconds.
23. Disconnect frequency counter from one second timer board.
24. Depress Push to Test switch and release. High voltage should be energized to 2 KV as indicated by kilovoltmeter on Hypot.
25. Create a failure by shorting High Voltage lead to Return lead of Hypot.
26. Hypot should go into failure mode and must be manually reset by pressing Reset switch.
27. Place the power switch in "OFF" position and disconnect cables from Hypot.
28. Glyptol R302 and secure lid on unit.
29. Place one second timer switch in "OFF" position.
30. Continuity with Inspection Procedure.